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Interference Handbook

Federal Communications Commission

CC1.7/4:

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INTRODUCTION

This handbook has been produced to help you resolve interference to your television, stereo or telephone equipment. Part I identifies some of the more common sources of interference to television reception. It also contains illustrations of various types of interference that may affect your television reception. Recommendations to help you locate the source of the interference and determine an appropriate solution are provided. Part II concerns interference to other electronic equipment. Resolution of interference problems usually requires cooperation between equipment owners.

If the interference continues after you have followed the suggestions in this handbook, complete and mail the questionnaire on page 59 to the nearest FCC Office. Office addresses begin on page 36. Part III provides references for assistance from equipment manufacturers, distributors and service technicians.

The Commission encourages consumers to be sure that their TV, stereo, or other electronic equipment can sufficiently reject undesired radio frequency signals. Likewise, transmitter operators must take all necessary steps to reduce or eliminate interference from their equipment.

PART I

SOURCES OF INTERFERENCE TO TELEVISION RECEPTION

CHAPTER 1

TWO-WAY RADIO TRANSMITTER INTERFERENCE

This pattern may appear on your television screen when your set is receiving signals from a CB, amateur, police, or other two-way radio transmitter. The pattern will only appear when the operator transmits. It may vary according to the type of signal being received. You may also hear the operator's voice.

INFORMATION FOR TV OWNER

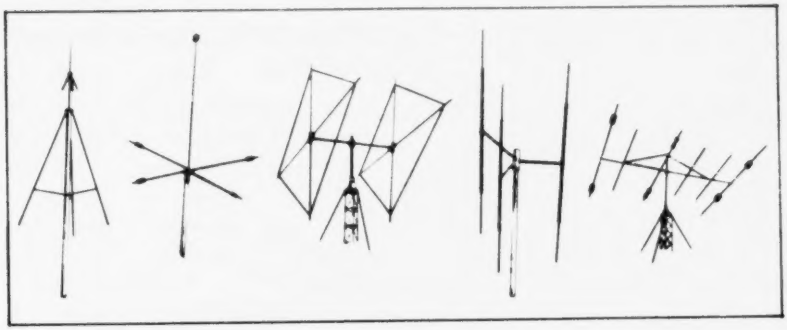
Your first step is to look for one or more of the common problems listed below and attempt the recommended solutions. These problems are all potential reasons why your television may receive interference.

PROBLEM:	RECOMMENDED SOLUTIONS:
VCR connection	See "VCR", page 15.
Cable TV connection	
—defective splitter	Repair or replace
—damaged cables	Contact cable company
—loose or open connectors	Contact cable company
—incompatible converter boxes	Replace if owned. If leased, contact cable company
—illegal taps	Remove or contact cable company
Broken or disconnected lead-in antenna wires	Replace or repair
Twin-lead antenna wire	Replace using coaxial cable with matching transformers (often called baluns)
Indoor antenna (rabbit ears)	Replace with an outdoor antenna
Poor outdoor antenna location	Reposition antenna for best reception
Distance from TV transmitter	Consider installation of a highly directional outdoor antenna if more than 25-35 miles from TV transmitter. See "fringe area reception," page 17.
Inadequate booster or distribution amplifier	Install filters, repair or replace malfunctioning amplifier as required. See "Booster amplifiers," page 16.

These common problems may not be the only cause of your interference. The recommended solution may not work. If your interference problem continues, try installing a high-pass filter on the back of your TV set at the antenna terminals. Follow installation instructions that accompany the filter.

If the filter does not work, you should locate the owner or operator of the radio transmitter. Give them a copy of the **Radio Transmitter Operator Information** section of this handbook. If you do not know who the operator is, check your neighbors' roofs and yards for one of the antennas shown below. Any radio transmitter within 500 feet of your residence can cause interference. If there are several antennas in your neighborhood, contact the owner of the one nearest you. Also attempt to determine if the nearest transmitter is being operated when your TV is receiving the interference. Your neighbors may also be able to help you locate the operator.

If the interference continues after the transmitter operator implements our recommended solutions, contact your equipment manufacturer or a qualified service technician for alternative solutions.



INFORMATION FOR RADIO TRANSMITTER OPERATORS

If you receive a complaint about interference from your radio transmitter you should voluntarily take the steps outlined below. This may prevent the Federal Communications Commission from directing you to do so.

The following problems are common reasons why transmitters cause interference. Follow the recommended solutions. If you need assistance with any of these solutions contact your dealer, equipment manufacturer, or a local transmitter repair shop. *NOTE: IT IS ILLEGAL TO USE A LINEAR AMPLIFIER WITH CB EQUIPMENT.*

INFORMATION FOR CB OPERATORS

PROBLEM:	RECOMMENDED SOLUTIONS:
Linear Amplifier	Permanently disconnect the illegal device.
Harmonics or spurious emissions	Install a low-pass filter in the transmitter antenna feedline.
Illegally installed equipment that *VIOLATES TYPE ACCEPTANCE RULES* such as extra channels, external attachments, rewired circuits or extra switches	Have transmitter technician or repair shop remove operator installed equipment.
Beam or high gain antenna	Rotate antenna in another direction, preferably away from nearby residences or Replace it with a non-directional antenna.
Location of antenna	Separate horizontally as far as possible from your neighbor's TV antenna or Raise your antenna's height as necessary within legal limits. (60 feet above ground, or up to 20 feet higher than highest point of the structure upon which it is mounted.)
Level of transmitter output power exceeds legal 4 watt limit	Reduce to 4 watts.
Transmitter grounds	Connect transmitter chassis to a good earth ground with large diameter wire or copper strap.
Loose chassis	Tighten the screws holding the chassis and case together. *Do not operate the transmitter with its case or cover removed.*

INFORMATION FOR AMATEUR OPERATORS

PROBLEM:	RECOMMENDED SOLUTIONS:
Harmonics and spurious emissions.	Install a low-pass filter in the antenna feed line, or in the coaxial link to the antenna tuner or Install a filter between the transmitter (exciter) and the input to the amplifier. A second filter should be installed at the amplifier's output.
Use of maximum power levels	Conduct tests by reducing your power to determine the effect that reduced power will have on the level of interference. If lower power operations reduce or eliminate the interference, you may wish to consider operating at the lower power whenever possible. This may help restore harmony to the neighborhood.
High gain or directional antenna	The effective radiated power (ERP) of high gain antennas operated at maximum power levels can create a "blanketing" effect. Consider using a non-directional antenna or reduced operating power.
Poor grounds	Ground transmitter to a metallic cold water pipe or a ground rod driven at least 8 feet into the ground. Ground lead should be at least #10 wire, copper ribbon or strap.

Local interference committees are available to help amateurs resolve their interference problems. For assistance in locating a committee in your area, contact the American Radio Relay League, Newington, Connecticut 06111, or the nearest FCC office listed on page 36.

CHAPTER 2

ELECTRICAL INTERFERENCE

PATTERN A

PATTERN B

Pattern A above may appear on your television screen when your set is reacting to an electrical device operating in or near your home. Pattern B can be caused by radio frequency energy generated by power lines or power line equipment. One way to determine if the interference is confined to your home is to check whether your neighbors are also experiencing the problem. If not, the interference is probably caused by something within your home. The operation of electric razors, hair dryers, electric drills and saws also cause temporary interference problems. You may choose to tolerate these types of interference since they are temporary and often expensive to eliminate.

COMMON ELECTRICAL INTERFERENCE SOURCES

The most common sources of electrical interference in the home are:

- Doorbell transformers (See page 12)
- Toaster ovens
- Electric blankets
- Fans
- Heating pads
- Light dimmer controls
- Switch contacts, such as those found on dishwashers, refrigerators and other home appliances
- Aquarium or waterbed heaters
- Sun lamps
- Furnace controls
- Smoke precipatators or detectors
- Home computers
- Ultrasonic pest control devices

- Lights: florescent and mercury vapor
- Neon signs
- Power company electrical equipment (See page 12)

Less common electrical interference sources include:

- Loose fuses or electrical wiring connections
- Sewing machines
- Electrical toys, such as trains
- Calculators
- Electric fences
- Cash registers
- Lightning arrestors
- Video games

WARNING

TO AVOID AN ELECTRICAL SHOCK, ELECTRICAL OR ELECTRONIC EQUIPMENT SHOULD ONLY BE MODIFIED BY QUALIFIED SERVICE TECHNICIANS.

Portable AM radios are susceptible to electrical interference. Use your AM radio to conduct the following "test." This test may help you to locate the device that is causing interference to your TV.

Turn on the portable AM radio and place the indicator between stations at the lower end of the dial until you hear static or a buzzing sound. Move from room to room using the radio as a detection device to locate the source of interference. The noise will be loudest in the room where the interference is originating. Unplug each of the devices previously mentioned, one at a time, until the interference disappears from your TV. The device that you discover is causing the interference must be repaired or replaced.

Another way to discover the source of interference to your TV is to go to the main fuse or circuit breaker box in your home. Remove one fuse at a time, or shut off one circuit breaker at a time, and see if the interference goes away. If the interference does not disappear, replace the fuse or turn the circuit breaker back on. Continue this process until the interference disappears.

When the circuit that supplies the power to the TV is turned off, plug the TV into another circuit. This will enable you to determine if the interference is being generated by a device that is powered by the same circuit as your TV.

If the interference pattern disappears from your TV set when a fuse is removed or a circuit breaker is turned off, go to the area that receives the electricity supplied by the disconnected circuit. Look for any of the devices previously mentioned. If you find any of them, first, replace the fuse or turn the circuit breaker back on. Then unplug the device suspected of causing the problem. If several devices are on this circuit unplug them one at a time until the interference disappears.

If this process does not uncover the source of your interference, ask your immediate neighbors if they are also receiving the interference.. If so, your neighbors may want to run the same circuit breaker test.

POWER COMPANY ELECTRICAL EQUIPMENT

If you determine that the interference is not caused by any device in your home or that of your neighbor(s), contact the service department of your local power company. They should investigate the problem and take steps to correct it. You may want to assure that your power company checks for:

- Defective line insulators
- Loose or unbonded hardware
- Discharges from defective lightning arrestors
- Defective transformers

If the power company does not respond to your request for assistance, you may contact the nearest FCC office for help.

DOORBELL TRANSFORMERS

Doorbell transformers can cause interference to your television reception. This type of interference is characterized by Pattern A shown on page 10, which will appear at approximately seven second intervals. It might be helpful to understand why this occurs.

If a doorbell button is pressed too long or if the button becomes stuck, the doorbell power transformer can overheat, causing a fire hazard. For protection, doorbell transformers include an automatic safety switch that turns off the transformer when overheating occurs. After the switch automatically turns the transformer off, it will cool and turn itself back on. This automatic on/off cycle produces a small arc which causes electrical interference. This temperature sensitive device can become defective and react to surrounding temperature changes, especially when the transformer is located in a hot attic. Interference problems from doorbells are generally corrected by having an electrician replace the transformer. The doorbell button should also be examined for jamming, and replaced if defective.

CHAPTER 3

FM RADIO TRANSMITTER INTERFERENCE

This pattern may appear on your TV screen when interference is caused by signals from an FM radio transmitter. The Commission encourages new FM station applicants to consider potential wide spread interference problems and minimize them by selecting a proper transmitter location. FM station operators are required to respond to all reasonable interference complaints once the station begins operating. Therefore, you should first contact the FM Station Manager, Chief Operator or Chief Engineer for assistance. If only TV Channel 6 is affected, you should contact the TV station.

There are two common interference problems that involve FM stations. The first problem may arise when you are receiving a distant TV signal and a new FM station begins operating in your area. Your TV receiver may respond to the nearby FM signal, which may overpower your TV signals. It is important to recognize that TV signals are only designed to be received within a limited number of miles (or radius) of the transmitter. Any TV beyond this is called "fringe area" reception. Although fringe area reception may be satisfactory to you, you are only receiving a weak signal. That signal is highly susceptible to interference. Sometimes, installation of an FM band rejection filter and/or a highly directional antenna may reduce your interference problem. The Chief Engineer of the FM station is a good source of information about interference resolution techniques. if you are not satisfied with the station's response, contact your local FCC office listed in Chapter 7.

A second problem may arise when you attempt to receive a TV signal with a booster amplifier installed in your antenna system. Booster amplifiers are subject to overloading by strong nearby FM signals. When overloading occurs you should install an FM band rejection filter or a tunable FM rejection trap in the feedline between your antenna and booster. In extreme cases it may be necessary to install a second filter. If so, place the second filter in series with the first one, or at the input terminals of your TV receiver. If your booster amplifier is defective or malfunctioning, it could cause interference throughout your neighborhood. You should have any such booster repaired or replaced. See page 16 for more information on booster amplifiers.

CHAPTER 4

COMPUTERS, PAGING SYSTEMS, VIDEO CASSETTE RECORDERS (VCRs), BOOSTER AMPLIFIERS

COMPUTER INTERFERENCE

Computer interference will normally disrupt only your TV reception. Greater distances between the TV and computer may resolve the problem. Occasionally, your computer system may cause interference to your neighbor's TV reception. If this occurs, you are required to discontinue using your computer system until you can eliminate the interference problem.

Consult your owner's manual or the computer dealer or manufacturer.

PAGING SYSTEM INTERFERENCE

You may hear the tone or voice transmission from a one-way common carrier paging system coming through your TV set. The Commission requires paging system operators to respond to interference caused by their transmissions while in the developmental licensing process. If the operator fails to respond to your request, you may contact your local FCC office listed in Chapter 7 of this handbook.

VIDEO CASSETTE RECORDERS (VCRs)

VCRs can receive interference from nearby radio transmitters. To determine if your VCR is receiving the interference and not your TV, turn your TV on, and your VCR off. If the interference continues, the unwanted signal may be entering through either your TV set or antenna system. If the interference disappears, your VCR is picking up the signal.

There are several ways that interference may enter a VCR:

- Directly through the VCR case to its internal components
- Through VCR connections and/or cables
- Through the power cord

Possible solutions include:

- Replacing connecting wires with coaxial cables
- Replacing push-on connectors with screw-on connectors

If these do not work contact the VCR manufacturer for alternative solutions.

BOOSTER AMPLIFIERS

A variety of patterns may appear on your TV screen because of booster amplifier interference. Sometimes a wavy pattern may appear, or the screen may black out for short intervals. If your antenna system uses a booster amplifier, disconnect it. Then connect the antenna directly to your television set. If the interference disappears, have your booster amplifier repaired or replaced. If your TV is connected to a Master Antenna Television (MATV) system, and is receiving interference, contact the building management. If you own your TV antenna system, attempt to locate the amplifier. Amplifiers can be located:

- On the back of a TV
- On an outdoor antenna
- Along a distribution wire that leads from the antenna to the TV
- In a clothes closet, basement, attic or garage

If the interference persists with your amplifier disconnected and bypassed, you may be receiving interference from a neighbor's amplifier. If several neighbors with booster amplifiers all receive interference, the one with the most severe interference is probably the one with the defective amplifier. Sometimes everyone in the neighborhood with an amplifier will have to disconnect and bypass their amplifier, one at a time, to discover which one is defective. Locating a defective amplifier can be difficult. The TV antenna connected to the defective amplifier can radiate interference over an entire neighborhood.

Booster and distribution amplifiers are also susceptible to nearby radio transmitter signals. The installation of filters before and after the amplifier will normally eliminate this kind of interference. If the amplifier is close to the TV, only one filter before the amplifier may be required.

CHAPTER 5

OTHER INTERFERENCE INFORMATION

FRINGE AREA RECEPTION

TV stations are intended to serve viewers only within a limited distance of their transmitters. Any TV reception beyond this distance is called "fringe area" reception. Although fringe area signals may be satisfactory, they are weak signals that are highly susceptible to interference and are not protected by the Commission. If the installation of a directional antenna or filter on your TV set fails to eliminate the interference problem, consider alternative TV services. Cable, satellite, and TV translators are possible alternatives.

GHOSTING

Two conditions may cause a double image of one TV program ("ghosting") to appear on your screen. Ghosting may be caused by the TV signal being reflected, or your TV's antenna or antenna lead-in wire may be in poor condition. Notice that the two images produced by ghosting are the same. Ghosting occurs when a TV signal is being reflected off a mountain, building, or other man-made structure. The signals travel over different paths to your TV set and arrive at slightly different times. Rotate your TV antenna to a new position, or install a shielded ("coax") lead-in wire. These measures may resolve this problem. If these solutions are not effective, have a service representative check the condition of your antenna and replace both the antenna and antenna lead-in wire.

CO-CHANNEL INTERFERENCE

Images from two TV programs will appear on your screen when your set simultaneously receives two TV signals. Note that the two images are different, as though one picture has been placed on top of the other. Co-channel interference may be caused by either atmospheric conditions, or the location of the TV station in relationship to your home. Problems caused by atmospheric conditions probably cannot be corrected. However, such conditions are usually temporary. Problems caused by the location of your home may be reduced or eliminated by installing a more highly directional antenna, or relocating the existing one to a position that best improves reception.

PART II

INTERFERENCE TO OTHER EQUIPMENT

CHAPTER 6

TELEPHONES, ELECTRONIC ORGANS, AM/FM RADIOS, STEREO AND HI-FI EQUIPMENT

Telephones, stereos, computers, electronic organs and home intercom devices can receive interference from nearby radio transmitters. When this happens, the device improperly functions as a radio receiver. Proper shielding or filtering can eliminate such interference. The device receiving interference should be modified in your home while it is being affected by interference. This will enable the service technician to determine where the interfering signal is entering your device.

The device's response will vary according to the interference source. If, for example, your equipment is picking up the signal of a nearby two-way radio transmitter, you likely will hear the radio operator's voice. Electrical interference can cause sizzling, popping or humming sounds.

When electrical interference occurs, you should try to locate the source of the interference. Follow the directions on page 10.

WARNING
TO AVOID AN ELECTRICAL SHOCK, ELECTRICAL OR ELECTRONIC EQUIPMENT SHOULD ONLY BE MODIFIED BY QUALIFIED SERVICE TECHNICIANS

TELEPHONES

Signals from nearby radio transmitters can enter your telephone system through:

- The telelphone wire leading to the house
- The telephone wiring inside the house
- The telelphone itself

The interference will frequently enter through the telephone itself. Many new models (both pulse and tone types) include features such as automatic redialing and push-button dialing. These features use transistor technology. The transistorized circuits in some of these telephones have not been designed to offer interference protection. Telephone interference can usually be eliminated by installing filters.

The effectiveness of filtering may vary according to the type of telelphone. In some cases, a filter installed at the microphone terminal inside the mouthpiece of the handset will eliminate the problem. Modifying your telephone may sometimes be impractical or expensive. When it is, consider changing to another brand or model with better interference protection. Price does not necessarily insure good interference protection.

CORDLESS TELEPHONES

Cordless telephones use radio frequencies. They are actually small two-way radio systems. As with any two-way radio, they are susceptible to interference from nearby radio transmitters, including other nearby cordless telephones. The FCC does not protect cordless telephones from interference. However, you may contact the manufacturer of the telephone for assistance. If your cordless telelphone causes interference to someone else's equipment, you must stop using it until the interference is eliminated.

SERVICE REFERRALS

IF YOU:	CONTACT:
Own your own telephone	Dealer or manufacturer's service representative
Lease your telephone	Your telephone company's service center
Own a cordless telephone	Manufacturer or dealer

WARNING

Telephones may only be internally modified by the manufacturer or an FCC registered telephone refurbisher. This rule is designed to ensure that telephones continue to comply with FCC registration standards. The local telephone company may also be willing to modify your equipment. Some states allow telephone companies to charge for this service, regardless of whether you lease or own your telephone.

ELECTRONIC ORGANS

If your electronic organ receives radio transmitter interference, contact your electronic organ manufacturer.

AM AND FM RADIOS

Sources of interference to television reception can also cause interference to AM and FM radio reception. Refer to Part I of this handbook.

If your AM or FM radio is receiving electrical interference, relocation of the radio within the home may reduce the interference to a tolerable level. If this does not work, locate the electrical device by using the information beginning on page 10 of this handbook.

Other interference problems may be caused by:

- receiver overload from a nearby transmitter of any type, or
- spurious emissions from a nearby amateur or CB transmitter.

The most likely problem to occur is receiver overload. When overload occurs, it can often be corrected by installing filters or making other modifications to the affected receiver. If spurious emissions are the problem, filtering of the transmitter must be made. Therefore, you should try to locate the transmitter operator. Information about locating transmitter operators begins on page 7 of this handbook.

If one radio station can be heard at two points on the dial, the problem may be due to "image response". If it can be heard on several adjacent channels, the problem may be due to poor receiver selectivity. It is usually impractical or expensive to modify the receiver to overcome these problems. Therefore, you may wish to consider changing to another model or brand of receiver.

WARNING
TO AVOID AN ELECTRICAL SHOCK, ELECTRICAL OR ELECTRONIC EQUIPMENT SHOULD ONLY BE MODIFIED BY QUALIFIED SERVICE TECHNICIANS

STEREO AND HI-FI EQUIPMENT

Replace any unshielded wires in other equipment, such as stereos, hi-fi systems, or audio amplifiers with high quality shielded wires. If this does not resolve the problem, consult a qualified service technician.

CHAPTER 7

WHERE TO GET HELP

If you have followed the instructions outlined in this handbook but your interference problem continues, you may want to contact one of the sources listed below for alternative solutions. There may be something unique about your problem that requires a special solution.

In most cases, the addresses listed for associations and manufacturers are those of national offices. They will send your inquiry to a local representative for a response.

This section also includes the addresses of FCC office locations. The information from the questionnaire on page 59 may enable a FCC staff member to determine what additional steps are needed to resolve your problem. You may also use this questionnaire to help your manufacturer or service representative.

ASSOCIATIONS

Electronic Industries Association (EIA)

Ms. Sally Browne, Director of Consumer Affairs, Consumer Affairs, Consumer Electronics Group, Electronic Industries Association, 2001 Eye St., N.W., Washington, DC 20006, tel. 202-457-4922, may be contacted for assistance or recommendations in handling of RFI problems involving manufacturers not listed here, or for assistance when the product is no longer manufactured. For ELIA informatiional material on RFIL, forward an 8 " x 10" self-addressed envelope with 56 cents postage attached.

National Electrical Manufacturers Association (NEMA)

A number of groups within NEMA are active in the areas of RIV, EMI and EEN – principally the Power, Electronics and Communications Coordinating Committee, the Power Equipment Division, the Lighting Equipment Division, and the Energy Management Council.

NEMA Standards Publication No. 107, "Methods of Measurement of Radio Influence Voltage (RIV) of High-Voltage Apparatus," covers the methods of Measurement of RIV in the frequency range of 0.015 to 30 MHz that may be associated with high-voltage power apparatus used on transmission and distribution systems at line voltages of 0.6 kilovolt and above. Originally developed in collaboration with the Edison Electric Institute and the Radio Manufacturers Association (now the Electronic Industries Assn. NEMA Publication 107 has since been adopted into the specifications of various utilities and government agencies, including the Rural Electrification Administration. It is currently being revised. A new edition is expected in 1986.

MANUFACTURERS

Admiral

No longer in business. For parts telephone 800-447-8361.

Akai America

Akai products include audio tape recorders, video tape recorders, AM-FM receivers, speaker systems and related accessory products. Inquiries related to RFI should be addressed to the Customer Service Manager, 800 W. Artesia Blvd., Compton, CA 90220, tel. 213-537-3880. "Upon receipt of these inquiries, we will investigate the situation and, to our utmost, try to resolve the customer's problems with general guidelines for solving the RFI."

Allen Organ Company

When a complaint is received via a dealer, Allen Organ Co. sends the dealer an informational service bulletin on RFI and sufficient components to cover all amplifiers in the affected instrument. This service is offered at no cost to the customer. Refer RFI problems to the local Allen dealer. Inquiries may be made to National Service Manager, Macungie, PA 18062, tel. 215-966-2200.

Altec Lansing International

Customer RFI problems are referred to the authorized Altec warranty stations located nationwide and denoted by an information card furnished with each piece of equipment. Unusual situations are, at the option of the warranty station, referred to Altec Customer Service. Contact Altec Lansing International, Jim Brown, 10500 West Rino, Oklahoma City, OK 73126, tel. 405-324-5311.

Apple Computer, Inc.

Apple products include business, professional, educational, scientific, industrial and home computers, peripheral devices, and software. These products are designed to be compliant with the FCC guidelines covering Class A and Class B computer devices. Inquiries related to RFI should be addressed to any of our more than 800 dealer-operated Level One service centers. If the service technicians there are unable to solve the situation, they will contact the Corporate Engineering Services Group. Inquiries may be sent to Apple Computer, Inc., 20525 Mariani Ave., Cupertino, CA 95014, mail stop 26A.

Arvin Industries, Inc., Consumer Electronics Division

Customer problems involving RFI should be referred to Mr. John Currey, Manager, Engineering Support Group, E. 15th St., Columbus, IN 47201, tel. 812-379-3000.

Audio Research Corporation

In the event of an RFI problem, the customer may write to Mr. Richard Larson, Chief Engineer, 6801 Shingle Creek Pkwy., Minneapolis, MN 55430, tel. 612-566-7570.

Baldwin Piano and Organ Company

RFI complaints are usually handled by the local Baldwin service technician. Factory personnel are available to assist technical representatives who travel in the field and may be called upon to assist a dealer technician with difficult problems, including RFI. Several Baldwin Technical Manual Supplements are available with specific instructions for RFI suppression on specific models. This information is readily available upon request. Inquiries may be directed to Mr. Gilbert C. Carney, Manager, Organ Technical Service, Baldwin Piano and Organ Co., 1101 S. Beechwood, Fayetteville, AR 72701, tel. 501-443-1311.

Bearcat (see Electra Co.)

Bogen Division of Lear Siegler, Inc.

Bogen Division manufactures professional, commercial and industrial sound equipment. In the event of an RFI problem with any Bogan unit, write for the division's free Field Service Bulletin No. 59 about RFI signal interference, or contact Allen Guthman, Service Manager, Bogen Division/LSI, Box 500, Paramus, NJ 07652, tel. 201-343-5700.

Carver Corporation, Inc.

Carver Corporation manufactures high fidelity components. "Problems pertaining to RFI should be directed to P.O. Box 664, 14304 N.E. 193rd Pl., Woodinville, WA 98072, tel. 206-775-1202."

Conn Keyboards, Inc.

RFI complaints should be referred to the local Conn dealer. Factory assistance is available to any local servicer who is unable to correct the RFI. Contact the Organ Service Department, P.O. Box 352, French Lick, IN 47432, tel. 812-836-9200.

Crown International

Crown International is the manufacturer of high-end audio products. RFI suppression is incorporated in the design of the product. If a customer should encounter an RFI problem, contact the Technical Services Department of Crown International, 1718 W. Mishawaka Rd., Elkhart, IN 46517, tel. 219-294-5571.

Curtis Mathes

Curtis Mathes products include color TVs and Stereos in portable, console and combination configurations. Customer complaints involving RFI should first be resolved at the retail-dealer level. If not satisfied, then the complaint should be made in writing to the Consumer Relations Department giving all details of the problem, along with the model information, serial number, date of sale, dealer and service history. Each complaint will be handled individually. Write to Curtis Mathes Manufacturing Co., Consumer Relations Division, 1220 Champion Circle, Suite 100, Carrolton, TX 75006, tel. 800-527-7646: Texas only tel. 800-492-9543.

Delco Electronics. Division of GM Corporation (see GM Corp.)

Dumont (see Emerson Radio)

Electra Company, Division of Masco Corporation of Indiana

Electra Co. asks that RFI problems with "Bearcat", its automatic scanning radios, be referred to its service department at Uniden Corp. of America, 6345 Castleway Court, Indianapolis, IN 46250, tel. 317-842-0280. Attn: Jim Holtel, Serv. Mgr.

Emerson Quiet/Kool Company (see Emerson Radio)

Emerson Radio Corporation

Customers may refer RFI inquiries related to Emerson Radio Corp. TV and radio problems to Mr. Dave Buda. Emerson Radio does not supply filters. The address is: Emerson Radio Corp., One Emerson Lane, North Bergen, NJ 07047, tel. 201-854-4800.

Epicure Products, formerly Elpa Marketing Industries, Inc.

Complaints are handled with respect to parts and labor on an individual basis. Necessary modifications for RFI are made on a no-charge basis for parts and labor during the term of instrument warranty. Beyond warranty, modification parts are available free of charge. The customer then pays for labor involved in the installation of parts. Refer RFI problems to Mr. Jim Orman, National Service Manager, 25 Hale St., Newburyport, MA 01950, tel. 800-225-7932.

Fannon Courier Corporation

If any RFI problems are encountered with units in the Fannon Courier product line, individuals should contact Mr. Mike Santana, Vice President of Engineering, 15200 San Fernando Mission Blvd., Mission Hill, CA 91345, tel. 213-365-2531.

Fisher Corporation

Fisher Corporation asks that RFI problems involving a Fisher product be handled as follows: request assistance from the local selling dealer or request assistance from the local Fisher authorized service station (a list is packed with every Fisher unit). Contact with local Fisher agencies is the preferred method of handling. Fisher's service coordination group maintains close communications with Fisher's authorized service stations and Fisher's Engineering Department, and works under the supervision of the office of the National Service Manager. If the problem cannot be solved at the first two service levels, contact Service Coordination, 21314 Lassen St., Chatsworth, CA 91311, tel. 818-998-7322.

General Electric Company

RFI problems involving G.E. television receivers should be referred to General Electric Customer Care Service Operation. If G.E. Customer Care Service is unable to correct the RFI, the customer should refer the problem to General Electric Company, Mr. R.C. Stell,, Consumer Electronic Business Operation, Portsmouth, VA 23705, tel. 804-483-5652.

General Motors Corporation

From time to time you may have questions concerning the electromagnetic compatibility of mobile transmitters when installed on General Motors vehicles. To help avoid such questions from arising, it is urged that care be taken to follow any applicable GM service procedures. The local GM Service Manager for the Car or Truck Division whose vehicle is involved should be contacted for information about such service procedures. If you are unable to obtain such assistance locally or if questions nevertheless arise, GM has established a central contact point for all such inquiries. Accordingly, you should direct your inquiries to: Mr. Henry J. Lambertz, GM Service Research (GMSR), Service Development Center, 30501 Van Dyke, Warren, MI 48090, tel. 313-492-8448. He will direct your inquiries to the appropriate division or staff within GM and follow up to see that appropriate action is taken.

Gulbransen, Division of CBS Musical Instruments, Inc.

Gulbransen cooperates with dealers and customers in offering suggested solutions to RFI. Gulbransen does not reimburse the consumer for servicing. When extreme cases are encounterd because of the proximity of the transmitter and relative power, however, the dealer may sometimes absorb the cost of servicing RFI problems. Customers should refer RFI problems to the local dealer. Inquiries may be directed to Mr. J.A. Iacono, Consumer Service Supervisor, 105A East Penn St., Hoopeston, IL 60942, tel. 217-283-5010.

H.H. Scott, Inc.

This manufacturer offers a simple instruction sheet to aid customers in resolving problems involving RF pickup. The information includes suggestions about suitable equipment grounding, power-line bypassing, and hints and suggestions on how to determine where RF is entering the equipment. "Customers should refer any RFI problems to Mr. D.F. Merryman, Engineering Dept., 20 Commerce Way, Woburn, MA 01888, tel., 617-933-8800."

Hammond Organ Company

RFI difficulties are usually handled by the local Hammond dealer service technician. Hammond maintains a staff of technical service representatives who travel in the field and may be called upon to assist local dealer technicians with difficult or unusual service problems, including RFI. Hammond states that the services of the Engineering and Technical Field Service Department under its control are provided to consumer and dealer without charge. RFI problems should be referred to the local Hammond dealer. Inquiries may be directed to the Hammond Technical Service Department, 4200 W. Diversey Ave., Chicago, IL 60639. Attention: Jerry J. Welch, tel. 312-283-2000.

Harman/Kardon, Inc.

RFI problems should be directed to Harman/Kardon at 240 Crossways Park West, Woodbury, NY 11797, tel. 516-496-3406. Attention: Customer Relations Dept.

Heath Company

Heath Co. suggests that, for fastest service on matters related to RFI, regardless of the product line involved, customers may now reach the Technical Consultation Department by either writing directly to that department at Heath Co., Benton Harbor, MI 49022, or by using a new direct-line telephone system to the department by calling 616-982-3302. Do not write to an individual.

Hitachi Sales Corporation of America

Hitachi's primary products are TVs, radios, tape recorders, hi-fi components and video tape recorders. Hitachi Sales Corp. of America attempts to cure each RFI problem on an individual basis. Customers should provide model number and information concerning the nature of the problem. RFI problems should be referred to the nearest Hitachi Regional Service Office. *Eastern Regional Office,* 1290 Wall St. West, Lyndhurst, NJ 07071, tel. 201-935-8980, Attention: Service Dept. *Midwestern Regional Office,* Elk Grove Village, IL 60007, tel. 312-593-15500, Attention: Service Dept. *Western Regional Office,* 401 W. Artesia Blvd., Compton, CA 90220, tel. 213-537-8383. Attention: Service Dept. *Southern Regional Office,* 510 Plaza Dr., College Park, GA 30349, tel. 404-763-0360. Attention: Service Dept.

J.C. Penney Company, Inc.

J.C. Penney Company asks that customers with RFI problems contact their nearest J.C. Penney store for personal assistance, J.C. Penney Company, Inc., 1301 Avenue of the Americas, New York, NY 10019.

JVC

JVC Company of America requests that customers with RFI problems contact JVC Customer Relations Department at 41 Slater Dr., Elmwood Park, NJ 07407, tel. 201-794-3900.

Kenwood Electronics, Inc.

Kenwood asks that customers with RFI problems take the affected unit to an authorized service center where an adjustment will be made at no cost to the customer if the product is properly registered with Kenwood and is within warranty. It is suggested that prior authorization for the return be obtained from Mr. Toshi Furutsuki, 1315 E. Watsoncenter, Carson, CA 90745, tel. 213-518-1100.

Lowrey Division of Norlin Music, Inc.

Lowrey customers should refer RFI problems to the local Lowrey dealer or certified Lowrey technician. Lowrey provides all technicians with technical literature regarding RFI and will provide assistance to local service organizations through its staff of field technical representatives when needed. Inquiries may be directed to Mr. Larry R. Thomas, Director of Product Service, 707 Lake Cook Rd., Deerfield, IL 60015.

Magnavox, Division of North American Philips Corporation

Refer all RFI complaints concerning Magnavox products to NAP Consumer Electronics Corp., P.O. Box 112, Old Andrew Johnson Highway, Jefferson City, TN 37760, tel. 615-475-3801.

Marantz/Superscope Corporation

Marantz/Superscope manufacturers AM/FM receivers, tuners, amplifiers, tape recorders, record players and audio systems. In the event of special RFI cases resulting from extremely high fields, contact the Technical Services Dept. at Superscope corporate offices. Modifications necessary to resolve such RFI problems are provided to customers on an individual basis. Marantz/Superscope Corp., 20525 Nordhoff St., Chatsworth, CA 91311, tel. 818-998-9333. For Service Dept., call toll free, 800-423-5108. Attention: Mr. Albert Almeida, National Service Manager.

McIntosh Laboratory, Inc.

"McIntosh has a number of authorized service agencies located throughout the country. Customers will be assisted to receive prompt help. RFI and other service-related problems can be directed to Mr. Michael Spencer, Customer Service Manager, 2 Chambers St., Binghamton, NY 13903, tel. 607-723-3512."

MGA Mitsubishi Electric Sales America, Inc.

MGA is the new sales and service representative for the Mitsubishi Electric Corp. RFI reports from the field, beyond the dealer's capability to resolve and in which MGA becomes involved, are handled on an individual basis. All attempts will be made to give customer satisfaction. MGA suggests that requests for assistance be addressed to 3030 E. Victoria St., Compton, CA 90221, or the Customer Service Department may be contacted by telephone, toll free, at 800-421-1132.

Midland International Corporation

If any RFI problems are encountered with Midland portable black-and-white and color TVs or audio and radio products, individuals should contact Mike Land, Customer Service Manager, P.O. Box 1903, Kansas City, MO 64141, or at 1690 N. Topping, Kansas City, MO 64120, tel. 816-241-8500.

Montgomery Ward

Service for RFI should be obtained from the nearest Montgomery Ward location. If service is not obtainable locally, the customer may write to: Customer Service Product Manager, Corporate Office, Montgomery Ward Plaza 4-N, Chicago, IL 60671. The Montgomery Ward field service organization can call upon factory and corporate engineering talent for assistance in handling difficult RFI problems.

Morse Electro Products Corporation (See Pilot Audio Systems)

Nikko Audio

Nikko's line of products includes stereo receivers, tuners, amplifiers, combination pre-amp and main-amp pairs, tape decks and signal processors. For information and asssistance with any Nikko products, inquiries should be made to Mr. Robert Fontana, National Service Manager, Service Dept., 320 Oser Ave., Hauppauge, NY 11787, tel. 516-231-8181.

North American Philips (NAP Consumer Electronics)

Refer Radio Frequency interference complaints to: Consumer Affairs Manager, Box 555, Jefferson City, TN 37760. NAP Corporate Offices are located at: NAP Consumer Electronic Corp., Interstate 40 and Strow Plains Pike, Knoxville, TN 37914.

Nutone Division

Refer RFI problems to Mr. Norman W. Aims, Field Services, Scovil Housing Products Group, Madison and Red Blank Rds., Cincinnati OH 45227, tel. 513-527-5100.

Odyssey (See North American Philips)

Panasonic Company

When instances of RFI occur, the customer should contact Panasonic at the following address: Panasonic Co., Division of Matsushita Electric Corp. of America, One Panasonic Way, Secaucus, NJ 07094. Attention: Supervisor of Quality Assurance Group, tel. 201-348-7000. The customer should provide model number, serial number and information concerning the problem. Upon review of the problem, the customer will be contacted and advised where to return the unit for corrective repair. Panasonic will absorb both parts and labor costs in these instances.

Phase Linear Corporation (Division of International Jensen, Inc.)

RFI problems should be directed to Phase Linear Service Dept., Attn. John Astwan, Director of Customer Service, 4136 N. United Pkwy., Schiller Park, IL 60176, tel. 800-323-0221.

Philco (See North American Philips)

Pilot Audio Systems

"RFI complaints related to Morse and Pilot Audio products may be referred to Karen Hansen, Director of Service Parts Dept., 3444 Morse Dr., Dallas, TX 75211, tel. 800-527-6422."

Pioneer

Contact Manager, Consumer Services Department, Pioneer Electronics (USA), Inc., Box 1760, Long Beach, CA 90801. Upon receipt of informtion concerning RFI problems, the Manager will forward the received information to the proper person within the company who can best help resolve the specific problem. Pioneer brand video products, including Laser-Disk players, are distributed by Pioneer Video, Inc., Montvale, NJ. Pioneer audio products are distributed by Pioneer Electronics (USA), Inc., Long Beach, CA. The "Point of Contact", above, will serve both companies.

Quasar Company (Matsuhita Corporation of America)

For a high-pass filter, the consumer should contact Quasar Co., Consumer Relations Manager, Mr. George Datilio, 9401 W. Grand Ave., Franklin Park, IL 60131, tel. 312-451-1200. Model and serial number of the receiver and frequency of the interfering signal, if known, should be included with the written request, as well as whether sound or picture, or both, are affected. The Quasar distributor serving the local area should be contacted relative to any other interference problem that is unique to Quasar products.

Radio Shack

Customers who encount[illegible] unique interference problems involving Radio Shack audio products ma[illegible]rite to Mr. Dave Garner or Mr. Randy Lehr, Product Development Engineers, National Headquarters, 1100 One Tandy Center, Fort Worth, TX 76102, tel. 817-390-3205.

RCA Consumer Electronics

"RFI problems involving both TV and audio products may be referred to Mr. J.J. Sanchez, Coordinator, Consumer Relations, P.O. Box 1976, Indianapolis, IN 46206, tel. 317-267-6445. Requests for filters should include model number and serial number of the RCA television receiver. Filter installation charges will be the customer's responsibility.

Regency Electronics, Inc.

Regency Electronics asks that RFI problems involving their scanners or marine products be referred to Michael Gregory, National Service Manager, 13528 S. Normandie Ave., Gardenia, CA 90249, tel. 213-317-0600. RFI problems will be handled according to the terms of our limited warranty.

Rodger Organ Company, Division of CBS Musical Instruments, Inc.

RFI problems involving the Rodgers Organ may be referred to Dale Justice, Custom Organ Test Department, 1300 N. East 25th Ave., Hillsboro, OR 97223, tel. 503-648-4181.

Rotel of America, Inc.

Stereo receivers, amplifiers, tuners and tape decks are made by Rotel. RFI problems should be referred to Michael Gregory, National Service Manager, 13528 S. Normandie Ave., Gardenia, CA 90249, tel. 213-327-0600. RFI problems will be handled according to the terms of our limited warranty.

Sansui Electronics Corporation

"RFI problems should be directed to Mr. L. Stogel, Phillip Stogel Advertising Agency, 19 W. 44th St., New York, NY 10036, tel. 212-302-5500. Mr. Stogel will direct the customer to an appropriate Sansui Service Center."

Sanyo Electric Inc. Consumer Electronics Division

In the event an RFI problem should occur, the customer is requested to take the set to the nearest Sanyo authorized repair station. Transportation to and from the shop is the responsibility of the customer. Should the shop not alleviate the problem, either the customer or the shop should contact Mr. Brad Coulter, Consumer Relations Manager, Sanyo Electric Inc., Electronics Division, 1200 W. Artesia Blvd., Compton, CA 90220, tel. 213-537-5830.

Scientific Audio Electronics, Inc.

Refer RFI inquiries to Mr. Michael L. Joseph, National Marketing Manager, or contact Mr. Robert Hunt, National Service Manager, 701 E. Macy St., Los Angeles, CA 90012, tel. 213-489-7600.

Sears Roebuck and Company

Sears asks that customers with RFI problems involving a Sears Product contact the nearest Sears service department for assistance. Inquiries may be directed to Sears Tower, Dept. 731A, Tech. Mgr., Div. 57, BSC, 39-9 Chicago, IL 60684, tel. 312-875-2090.

Sharp Electronics Corporation

Sharp Electronics will, with proof of purchase, supply customers with a Drake TV-300 high-pass filter at no cost. Audio rectification problems are handled on an individual basis by the Service Department. Refer RFI problems to Service Manager, 2 Sharp Pl., Paramus, NJ 07652, tel. 201-265-5600, ext. 3357.

Sherwood, Division of Inkel Corporation

Customers with interference problems should contact Mr. David Daniels, Vice President Marketing, 17107 Kingsview Ave., Carson, CA 90746, tel. 213-515-6866.

Shure Brothers, Inc.

The manufacturer recommends the use of balanced-line, low impedance microphones and cables. If an RFI problem persists after the above measures have been taken, the customer should contact Shure Brothers, Inc. with specifics so that they may be able to help solve the problem. Refer RFI problems to Customer Services Dept., 222 Hartrey Ave., Evanston, IL 60204, tel. 312-866-2200.

Sony Corporation of America

Primary products of Sony are color televisions, black-and-white televisions, video tape recorders, stereo equipment, audio components and word-processing equipment. RFI assistance is provided through Sony Information Center, Sony Corporation of America, Sony Dr., Park Ridge, NJ 07656, tel. 800-222-SONY.

Sound Concepts

All RFI complaints are handled at the main laboratories at 27 Newell Rd., Brookline, MA 02146, tel. 617-566-0110. The offending unit should be accompanied by a description of the nature of the RFI; there is no charge for this service.

Soundesign Corporation

Soundesign Corp. Acoustic Dynamics requests that all service problems relating to nonstereo merchandise be referred to Mr. Thomas R. Greene, Administrative Vice President, 34 Exchange Pl., Jersey City, NJ 07302, tel. 201-434-1050. All service problems on stereo merchandise are to be referred to our authorized service centers. The nearest one can be found by calling toll free in the continental U.S., 800-631-3092.

Sylvania/Philco (See North American Philips)

Tandberg of America, Inc.

When RFI occurs in Tandberg products, the manufacturer suggests that the unit be returned to them. Tandberg will do any modification possible to eliminate the RFI. Authorization should be obtained from Mr. Tor Sivertsen prior to return of the unit. Mr. Tor Sivertsen, Technical Vice President, Labriola Ct., Armonk, NY 10504, tel. 914-273-9150.

Thomas International Electronic Organs (See Whirlpool Corp.)

Toshiba America, Inc.

Customers should contact the nearest regional office, listed below, to obtain assistance in solving RFI problems involving Toshiba amplifiers, tuners and receivers. Mr. C. Rovertello, *Eastern Regional Service Manager*, 82 Totowa Rd., Wayne, NJ 07470, tel. 201-628-8000. Mr. R. Fischer, *Mid-West Regional Service Manager*, 2900 MacArthur Blvd., Northbrook, IL 60062, tel. 312-564-5110. Mr. C. Cathcart, *Western Regional Service Manager*, 19500 S. Vermont Ave., Torrance, CA 90502, tel. 213-538-9960.

U.S. JVC Corporation (See JVC)

U.S. Pioneer Electronics Corporation (See Pioneer)

Wells-Gardner Electronics Corporation

Wells-Gardner is a private-label manufacturer of consumer products. Inquiries related to RFI should be referred to the private-label customer (distributor) whose address appears on the model-number label attached to the product. Special problems which may be encountered by private-label customers (distributors) are usually referred to Wells-Gardner, Mr. Harry McComb, Service Manager, 2701 N. Kildare Ave., Chicago, IL 60693, tel. 312-252-8220.

Whirlpool Corporation

RFI complaints related to older Thomas organs may be sent to Mr. Daniel Hofer, Service Manager, Thomas Products, 100 Progress Rd., Lombard, IL 60148, tel. 800-323-4301.

Wurlitzer Company

The Wurlitzer Company makes available a toll-free telephone line, 800-435-2930, to assist any technician or customer in any and all needs pertaining to Wurlitzer products. The Wurlitzer Company maintains a staff of field service managers who can assist should an RFI problem arise. John L. Yousling,, Manager, Consumer and Marketing Services, Wurlitzer Co., 4103 E. Gurler Rd., DeKalb, IL 60015.

Yamaha International Corporation

The Yamaha organization attempts to cure each RFI problem on an individual basis. Yamaha supplies all necessary technical information at no charge. If interference is caused by design error, Yamaha takes steps at its own expense to remedy the problem. Refer RFI problems to the local dealer. The dealers are kept well informed and current on RFI countermeasures. Inquiries may be directed to Mr. L. Bower, Electronic Service Manager, Electronic Service Dept., P.O. Box 6600, Buena Park, CA 90622, tel. 714-522-9352.

Zenith Radio Corporation

Zenith gives consideration to handling and providing relief for RFI problems on a case-by-case basis. RFI problems should be referred to the Service Division, 11000 W. Seymour Ave., Franklin Park, IL 60131, tel. 312-671-7550. RFI referrals should include model and serial numbers of the affected unit. Customers with a unique, difficult problem may direct a letter to Mr. Art Kass, Manager of Customer Service, at the same address.

FCC OFFICE ADDRESSES

ALASKA, Anchorage
6721 West Raspberry Road
Anchorage, Alaska 99502
Phone: (907) 243-2153

CALIFORNIA, San Diego
7840 El Cajon Blvd., Suite 405
La Mesa, California 92041
Phone: (619) 293-5478

CALIFORNIA, Long Beach
3711 Long Beach Blvd., Suite 501
Long Beach, California 90807
Phone: (213) 426-4451

CALIFORNIA, San Francisco
424 Customhouse
555 Battery Street
San Francisco, California 94111
Phone: (415) 556-7701

COLORADO, Denver
12477 West Cedar Drive
Denver, Colorado 80228
Phone: (303) 236-8026

FLORIDA, Miami
Koger Building, Suite 203
8675 NW 53rd Street
Miami, Florida 33166
Phone: (305) 350-5542

FLORIDA, Tampa
1211 N. Westshore Blvd.
Interstate Bldg., Room 601
Tampa, Florida 33607
Phone: (813) 228-2872

GEORGIA, Atlanta
Massell Building, Room 440
1365 Peachtree Street, N.E.
Atlanta, Georgia 30309
Phone: (404) 347-3084

HAWAII, Honolulu
P.O. Box 1030
Waipahu, Hawaii 96797
Phone: (808) 677-3318

ILLINOIS, Chicago
Park Ridge Office Center
1550 Northwest Highway
Room 306
Park Ridge, Illinois 60068
Phone: (312) 353-0195

LOUISIANA, New Orleans
800 West Commerce Street
Room 505
New Orleans, Louisiana 70123
Phone: (504) 589-2095

MARYLAND, Baltimore
1017 Federal Building
31 Hopkins Plaza
Baltimore, Maryland 21201
Phone: (301) 962-2729

MASSACHUSETTS, Boston
1600 Customhouse
165 State Street
Boston, Massachusetts 02109
Phone: (617) 223-6609

MICHIGAN, Detroit
24897 Hathaway Street
Farmington Hills, Michigan 48018
Phone: (313) 226-6078

MINNESOTA, St. Paul
691 Federal Building
316 North Robert Street
St. Paul, Minnesota 55101
Phone: (612) 725-7810

MISSOURI, Kansas City
Brywood Office Tower, Room 320
8800 East 63rd Street
Kansas City, Missouri 64133
Phone: (816) 926-5111

NEBRASKA, Grand Island
P.O. Box 1588
Grand Island, Nebraska 68802
Phone: (308) 382-4296

NEW YORK, Buffalo
1307 Federal Building
111 W. Huron Street
Buffalo, New York 14202
Phone: (716) 846-4511

NEW YORK, New York
201 Varick Street
New York, New York 10014
Phone: (212) 620-3437

OREGON, Portland
1782 Federal Building
1220 S.W. Third Avenue
Portland, Oregon 97204
Phone: (503) 221-4114

PENNSYLVANIA, Philadelphia
One Oxford Valley Office Bldg.
2300 East Lincoln Highway,
Room 404
Langhorne, Pennsylvania 19047
Phone: (215) 752-1324

PUERTO RICO, San Juan
Federal Building & Courthouse
Avenida Carlos Clardon
San Juan Office, Room 747
Hato Rey, Puerto Rico 00918
Phone: (809) 753-4567

TEXAS, Dallas
9330 LBJ Expressway, Suite 1170
Dallas, Texas 75243
Phone: (214) 767-5690

TEXAS, Houston
1225 North Loop West, Room 900
Houston, Texas 77008
Phone: (713) 229-2748

VIRGINIA, Norfolk
Military Circle
870 North Military Highway
Norfolk, Virginia 23502
Phone: (804) 441-6472

WASHINGTON, Seattle
One Newport, Room 414
3605 132nd Ave., S.E.
Bellevue, Washington 98006
Phone: (206) 764-3324

CHAPTER 8

FILTER INFORMATION

The following table has been excerpted from "Field Resources Directory", 1985 Edition, American Radio Relay League (ARRL), Newington, Connecticut 06111. It is reprinted with their permission.

The table is based on the results of ARRL tests conducted on the filters listed. New filters are introduced into the marketplace each year, and others are discontinued. Although ARRL tried to make these tests as complete as possible some available filters may not be represented. Some of the filters listed may no longer be available.

Performance Summary

Manufacturer	Model No.	Attenuation (dB) 1.8-29.7 MHz (HAM)	26.9-27.5 MHz (CB)	54-216 MHz (TV)
Low-Pass Filters		LOWER = BETTER	LOWER = BETTER	HIGHER = BETTER
Barker & Williamson	425	0.3	0.3	56
Cornell Dubilier	CBTVI-1	1	0.8	26
Heath	HDP-3700	0.4	0.4	59
J.W. Miller	C-514-T	0.5	0.5	77
Microwave Filter Co.	Interfilter	0.2	0.2	70
R.L. Drake	TV-3300-LP	0.4	0.4	76
R.L. Drake	TV-42-LP	0.5	0.5	73
Wm. M. Nye Co.	250-0020-001	0.3	0.3	59
High-pass Filters		Higher = Better	Higher = Better	Lower = Better
† Archer	15-580	73	74	2.5
† Blonder Tongue	FR-CB-75	17	30	1
† Channel Master	7203	40	47	1.1
† J.W. Miller	C-513-2	62	63	0.5
† Marine Technology	EMI-TV75	68	68	0.6
† R.L. Drake	TV-75-HP	64	65	1

† R.L. Drake	TV-75-HP	70	74	2.2
† RMS Electronics	CA-2700	32	33	0.6
† Winegard	HP 2700	35	37	0.4
†† Archer	15-851	39	44	2.0
†† Antsco	MT-11CB	22	24	3.1*
†† Caltronics	CB/TV Noise Filter	0.9	0.9	0.7
†† Channel Master	0211	16	18	0.6**
†† Blonder Tongue	FR-CB-300	21	35	2
†† J.W. Miller	C-513-T1	69	69	3.9***
†† J.W. Miller	C-513-T3	62	62	2.3
†† J.W. Miller	C-510-T	22	23	1.4
†† Marine Technology	EMI-TV300	35	37	8.0
†† R.L. Drake	TV-300-HP	39	38	1.3
†† Vanco	TV-1	12	14	1
†† Vecor	922	24	26	1.3
†† Workman	TV-5	14	16	0.6

† for coax
†† for twin-lead

NOTES: All attenuation figures are worst case for the indicated frequency ranges.
*Includes losses in test setup. This filter has rejection of 6-m ham frequencies.
**This filter has rejection of FM broadcast and 2-m ham frequencies.
***Includes losses in test setup.

Power-line Filters		Higher = Better	Higher = Better
Archer Cornell	15-1110	8	—
Dubilier Cornell	CBAPF	14	29
Dubilier Cornell	NF 10286-1	20	21
Dubilier	NF 1A 364-3	45	45
J.W. Miller	7811	8	8
J.W. Miller	C-508-L	33	—
J.W. Miller	C-509-L	37	—
J.W. Miller	C-517-L1	27	—

Marine Technology	EMI-120V	8	32

Miscellaneous Filters

J.W. Miller	C-506-R	RF choke for use in stereo speaker leads.
J.W. Miller	C-505-R	RF Choke for use at input of audio amplifiers
Winegard	T-FM7	FM band rejection filter for 75 ohm lines.
Winegard	T-FM3	FM band rejection filter for 300 ohm lines.
Winegard	TR3-2FM	Trap to notch out undesired signals in 54-216 Mhz range in 300 ohm lines.
Winegard	FT-760	FM band tunable trap for 75 ohm lines.

CHAPTER 9

TECHNICAL INFORMATION FOR SERVICE TECHNICIANS

THIS SECTION OF THE HANDBOOK IS INTENDED FOR USE BY TV AND RADIO SERVICE TECHNICIANS. IT IS NOT INTENDED FOR USE BY THE GENERAL PUBLIC. TO AVOID ELECTRIC SHOCKS, ALL MODIFICATIONS TO ELECTRICAL OR ELECTRONIC EQUIPMENT SHOULD BE PERFORMED BY QUALIFIED SERVICE TECHNICIANS.

This chapter contains three sections. Section one involves radio transmitter modifications. Section two provides information about modifying televisions. Section three provides information about how to resolve FM, electrical and audio interference problems.

It would be helpful if the person you are assisting obtains the cooperation of the transmitter operator or complainant involved. This cooperation will enable you to determine if your modifications are effective.

SECTION ONE

RADIO TRANSMITTER MODIFICATIONS

If you are trying to modify a radio transmitter that is causing interference to television reception, you should determine the following:

1 Is the transmitter properly grounded? The transmitter should be connected to a good earth ground with a large diameter wire or copper strap. This will help reduce interference and the hazard of electrical shock or lightning damage. Wide straps have much lower impedance to RF energy than round wires. A single piece of wire connected to a ground rod may be an open circuit if its length is resonant at the radio frequency.

2 Are harmonics or spurious emissions present? If so, you should attempt to determine whether they are radiating from the:

—antenna
—transmission line
—transmitter cabinet
—power cord
—microphone cord
—other equipment attached to the transmitter, or
—any combination of the above

a First, place a low-pass filter in the antenna feedline, or in the coaxial link to the antenna tuner. If you are servicing an amateur transmitter with a linear amplifier attached, install a filter between the transmitter (exciter) and the amplifier input. Install a second filter at the output of the amplifier. LINEAR AMPLIFIERS CANNOT LEGALLY BE USED IN THE CB RADIO SERVICE.

b Next, add a line filter to the power cord in the AC outlet.

c Then, check for cable or cord radiation using the following: Move, twist, or loop the suspected cable or cord, or place your hand at various places along the cord. Observe (or have someone else observe) the level of TV interference while you are doing this. There will probably be substantial changes in the interference level if the problem is caused by cable or cord radiation.

d Make sure that there are no significant RF energy levels measurable on the exterior of the coaxial cable transmission line High RF levels may be caused by a poorly matched antenna system or a break in the antenna's transmission line.

e Make sure that all leads entering the transmitter cabinet are adequately filtered. Any transmitter with unfiltered leads or connectors is likely to cause interference. Leads and connectors should be filtered at the point that they enter the equipment chassis or metal cabinet.

f Signal leakage problems may originate from several different sources. Each leakage problem must be corrected individually. You may not notice any overall improvement until all of the sources have been corrected.

g You may also have to reposition the transmitter antenna away from the TV antenna.

3 If TV channel 2 is most severely affected, install an external low-pass filter. If one has already been installed, try wrapping three or four turns of the transmitter power cord near the chassis through a ferrite toroidal core. The core from a discarded TV deflection yoke or flyback transformer can be used. Cores are also available commercially.

SECTION TWO

RESOLVING INTERFERENCE AT THE TELEVISION RECEIVER

Review the "Information to TV Owner" section on page 6 of this handbook. Determine what steps your customer has taken to help resolve the interference problem. If they have not tried any of the recommended solutions, review the section mentioned above and try the recommended solutions. Then:

1 Prior to working on the TV receiver, try to determine the source of the interference and its frequency. If the interfering frequency is on or near the TV intermediate frequency (IF) frequency (between approximately 41 and 47 MHz), proceed directly to Step 7. For FM broadcast interference, proceed to Step 10. For 50 to 54 MHz amateur interference, proceed to Step 8. If the interference is not on any of the preceeding frequencies, try these next three steps:

a Disconnect the antenna lead from the TV receiver. If the receiver responds to the interfering signal while the antenna is disconnected, install an AC power line RF filter. This will help determine if the RF from the transmitter is entering the television via the power cord.

b Install a line filter which you may either purchase or construct by following the schematic in Figure 1.

AC Power Wiring Filtering

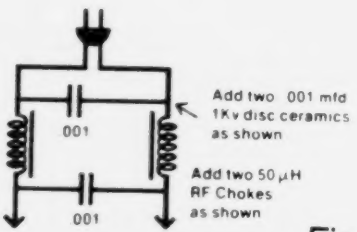


Fig. 1

c Try wrapping three or four turns of the TV set's power cord near the chassis through a ferrite torodial core. The core from a discarded TV deflection yoke or flyback transformer can be used. Cores are also available commercially.

2 The receiver may still continue to respond to the interfering signal, even with the power line filter installed and the receiving antenna disconnected. When this happens, the set itself is receiving the interfering signal directly through its internal components. Look inside the set for:

a Evidence of repair work that was performed without replacing the set's metal shields or housings. Reinstall them as necessary.

b Tuner defects. Ascertain that the tuner:

—is properly installed
—has its shielding intact
—has coaxial cables intact.

If necessary, repair or replace the tuner.

3 If you do not find any defects but the problem persists, try installing a high-pass filter (or a trap tuned to the interfering signal) directly at the tuner input terminals.

4 See page 40 of this handbook for more information about filters. Use high pass filters with the proper cutoff frequency. If a proper high pass filter does not provide sufficient attenuation, then install two filters in series.

5 Reconnect the antenna. If a high-pass filter has already been installed, and the interference continues, replace the 300 ohm twin-lead wire with shielded cable. Be sure to install balun transformers wherever needed.

6 If the interference continues, loop about 3 or 4 turns of the coaxial cable near the chassis through a ferrite toroidal core. The core from a discarded TV deflection yoke or flyback transformer can be used. Cores are also available commercially. An additional ferrite core, around which the power cord is looped, may also be helpful.

7 Determine whether the interference is affecting all TV channels. If so, it may be caused by the interfering signal being on the same frequency as the receiver's intermediate frequency (IF). Receiver IF interference only occurs when the interfering signal lies between 41-47 MHz. The most effective way to overcome the IF interference problem is to increase the TV signal level relative to the interfering signal. This is accomplished by:

   a Installation of traps and filters to eliminate preamplifier and receiver overloading by the unwanted signals, and

   b Using high gain antennas and signal preamplifiers to raise the level of TV signals at the receiver's antenna terminals enough to swamp out the interference. This technique does not eliminate the interference but may reduce it to a level which is not objectionable or not noticeable.

8 Another type of interference from a nearby radio transmitter is unique to the amateur 6 meter band, 50-54 MHz. This band is immediately adjacent to TV Channel 2. To resolve, install a high-pass filter with a cutoff frequency at 54 MHz. Two filters may be necessary. Try connecting them right at the tuner input terminals. If you install them elsewhere use shielded, short leads. You might also try repositioning the TV antenna farther away from the transmitter antenna.

9 If the interference continues after these measures, you must refer to the receiver service data. Check each stage for the undesired response. Long leads to speakers and audio volume or other controls are likely to pick up unwanted signals. Bypassing with capacitors to the chassis and the shielding of long leads often eliminates such signals.

10 There are several different ways FM Broadcast stations may interfere with television reception:

   a An educational FM station operating below 90 MHz may interfere only with TV Channel 6. (Refer to page 13.)

   b An FM transmitter in the immediate vicinity may cause blanketing of the TV receiver. The TV reception may appear weak, with or without accompanying interference patterns.

   c When a TV receiver is located near an FM transmitter, the internal TV radio frequency (RF) and mixer stages can function in ways that produce unwanted internal signals. This is often referred to as receiver generated harmonics.

11 The solutions to the above-described FM interference problems are:

a FM interference to TV Channel 6 can be eliminated by installing a tunable FM rejection trap. Tuning of the trap is critical. Accurately tune it to the interfering FM station's frequency.

b Blanketing interference can be eliminated by installing an FM band rejection filter in the antenna line or installing a tunable FM trap.

c Receiver generated harmonics in the RF input or mixer stages can be identified by the following two methods:

i introduce a known attentuation in the antenna feedline. Measure whether the harmonic level in the receiver is reduced by more than the amount of attentuation inserted. If so, the harmonics are being generated by the receiver.

ii Use two TV receivers that are different makes. They should both be the same type — either color or black and white. A receiver generated harmonic is unlikely to appear at the same intensity in two different receivers.

To correct receiver generated harmonics, install an FM band rejection filter or a tunable trap (tuned to the interfering station's frequency.)

SECTION THREE

ELECTRICAL, FM AND AUDIO INTERFERENCE

RESOLVING ELECTRICAL INTERFERENCE

Before proceeding, read the information on page 11. If you have completed those steps, you should already know the source of the interference.

WARNING: Check local electrical codes to determine if the device may be modified, and whether it must be modified by a licensed electrician. Modifications that involve bypassing with capacitors should be completed with extreme care to prevent the capacitors from shorting out the AC line. ***AVOID WIRING THAT COULD CONDUCT THE FULL AC LINE VOLTAGE TO THE CASE OF THE DEVICE. LINE VOLTAGE ON THE EXTERIOR OF DEVICES CAN BE LETHAL.***

ELECTRIC DRILLS, SAWS, MIXERS OR HAIR DRYERS

Interference from electric drills and saws is usually brief. You probably should not modify them. Modifications may be difficult and time-consuming. If modifications are required, the following information may be of assistance.

1 Drills, saws, mixers, hair dryers and other devices that use a simple AC/DC motor usually cause interference. This interference results from arcing between the brushes and commutator. The interference is then transmitted through the power cord and radiated by the cord and associated building wiring circuits. Most motors are wired in series, with the field coils connected between each brush and the power line. Field coils help to isolate the sparking brushes from the power line. The following measures may be used to correct this type of interference.

   a Solder a 0.001 mfd disc ceramic capacitor between each brush holder and the motor frame using the shortest possible connecting leads. Capacitors with a rating of 1,000 volts are preferable. Do not use capacitors with less than a 600 volt rating.

b If additional attentuation is required, connect additional 0.001 mfd disc ceramic capacitors between each side of the power line and the motor frame. Place them as close as possible to the point where the power wires enter the motor enclosure.

c Very short leads between the capacitor and motor frame are essential. If the motor is operated in a grounded metallic enclosure these recommended capacitors should reduce the interference to an almost inaudible level.

THERMOSTATS

Sometimes thermostatically controlled devices such as electric blankets, fish tank heaters, and home heating/cooling units cause interference. This type of interference is caused by arcing at the contact points. Arcing results from either worn contacts or failure of the snap action thermostat element to exert enough pressure on the contacts to prevent arcing. To correct this type of interference:

a Spray contact cleaner directly on the contacts if possible. This is a temporary measure.

b Replace the thermostatic control unit.

DIMMER OR COMBINATION CONTROLS AND SWITCHES

Light dimmer controls or combination controls and switches that utilize SCR or triacs can produce interference. This is due to the very steep wave front produced by the switching at the SCR or triac. Light dimmer controls do not often cause television interference. However, they do cause strong AM broadcast interference which may be difficult to completely eliminate.

Bypassing in the manner shown in Figure 2 may be helpful.

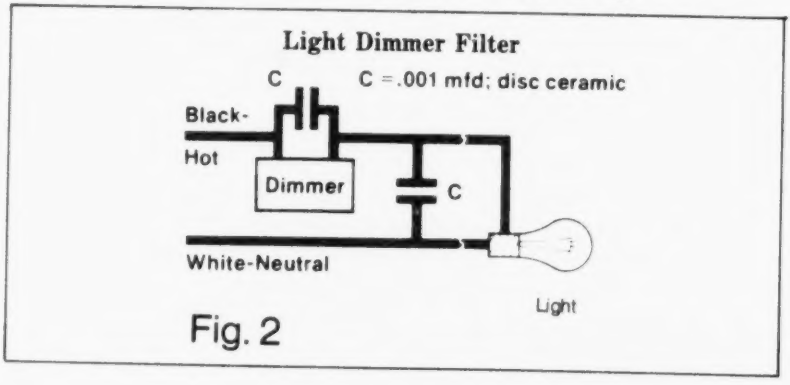


Fig. 2

ELECTRICAL INTERFERENCE CONDUCTED BY THE POWER LINE

To eliminate electrical interference conducted by the power line, install a power line filter at the interference source whenever possible. Power line filters are most effective when installed at the source of the interference rather than at the device receiving the interference. For best results, power line filters should be installed right at the interfering appliance with the shortest possible line cord. Otherwise, direct radiation from the line cord between the source and the filter will be troublesome, especially at VHF frequencies.

SUMMARY

Electrical interference is always best controlled by filtering, shielding and bypassing as close as possible to its source. When investigating electrical interference you should also keep in mind that the power distribution system can generate, transmit and radiate electrical interference. Such interference may appear similar to the type generated by defective electrical appliances. Power line interference is frequently caused by tree branches and foilage that comes in contact with high voltage lines, defective distribution transformers, circuit breakers, lightning arrestors, or power line insulators. Such interference cannot be resolved by the service technician. Report it to the power company. Sometimes the differentiation of appliance generated and power line generated electrical interference sources may be difficult. You may need to have power company service personnel and neighborhood residents cooperate to identify the source of the problem.

FM BROADCAST RECEIVER INTERFERENCE

1 FM receiver interference is not as common as TV interference. The narrower bandwidth of FM receivers coupled with their superior noise rejection capabilities makes them less susceptible to interference than TV receivers. However, when power line or other electrical interference is very strong, it may interfere with FM as well as TV receivers.

2 Portable FM receivers with self contained antennas may respond to strong signals on the image frequency, such as nearby aircraft. This is seldom a serious problem except near airports. When it is, an outside antenna will help to resolve the problem. It may also be necessary to install a tunable filter (tuned to the interfering signal) in the antenna line.

3 CB and amateur harmonics may occasionally interfere with certain stations. Harmonics can be eliminated only at the offending transmitter.

4 Blanketing in the vicinity of a high power FM broadcast transmitter may be troublesome and difficult to completely correct. Blanketing may cause low receiver sensitivity or limit reception to the one strong local station at all points on the dial. It may be necessary to resolve the problem by installing an external antenna and a rejection filter tuned to the local station's frequency. This may not be entirely satisfactory since the filter may also block other stations in the part of the broadcast band near the strong local station.

AUDIO INTERFERENCE

Audio interference is defined as the reception of unwanted radio frequency (RF) signals or energy by an audio amplifier or transducer. This undesirable reception occurs when the RF energy is rectified by any of the components or conditions listed below:

—diodes
—transistors and varistors
—integrated circuits
—electron tubes
—poor solder joints or
—faulty ground connections

The detected signal is then picked up by the audio device and processed along with the desired signal.

The effects of audio interference vary according to the type of modulation employed by the interfering transmitter as follows:

AM The voice or music will be heard as any normal audio signal applied to the amplifier. The interfering signal may be extremely loud and slightly distorted.

SSB On single sideband, the voices will sound garbled and unintelligible.

FM Usually no sound will be heard but the amplifier's volume will decrease when the interfering transmitter is on. Clicks may be heard when a two-way transmitter is keyed and unkeyed.

TV The audio rectification of a TV signal will make a loud buzzing noise. The buzz will change as the TV picture changes.

1 To resolve audio interference, you should first attempt to locate where the rectification is taking place in the audio chain. First, determine if adjusting the volume control effects the level of interference.

   a If the volume of the interfering signal changes when the volume control is moved, then the rectification is taking place BEFORE the volume control.

   b If moving the volume control has minimal or no effect, the rectification is occuring AFTER the volume control.

2 Proceed to the appropriate set of solutions outlined below. If these solutions do not resolve the audio interference problem, contact the manufacturer for further assistance.

   a *Rectification BEFORE the volume control.* The keys to resolving audio rectification are proper grounding, connections, shielding, and RF bypassing. A "process of elimination" approach must often be used. A multiple input audio amplifier may be susceptible to audio interference on one or several of the available inputs. Low level, high impedance inputs, such as those for turntable cartridges, tape heads and microphones are most susceptible. For example, the only input affected may be from a turntable. When this occurs, disconnect the turntable cartridge from the amplifier's input terminal. If the interference stops, the RF is sensed by either the cartridge or the wire between the cartridge and the amplifier.

   If it is due to broken or defective shielding on the wire, replace or repair the wire. If the RF is picked up directly at the cartridge, install a small RF choke and bypass capacitor. Be careful to not unbalance the pick-up arm or not use components that will change the frequency response of the system.

   b *Rectification AFTER the volume control.* Adjusting the volume control usually will not affect the interference level. When this happens, the RF signal is entering the circuit between the volume control and the amplifier output terminals. Begin to correct this problem by checking for unshielded long leads to a volume control. The RF signal must be blocked by shielding or filtering at the point of entry. It is important that the components selected for filtering do not alter the amplifier's audio response.

c *Grounding.* Whether separate equipment grounding is appropriate depends upon the type of equipment involved. Most equipment which is not equipped with a three wire power cord should have its chassis and cabinet grounded with a separate ground connection. It is generally safest to connect all grounds to a good earth ground, such as a metallic water pipe or a driven 8 foot ground rod.

d A ground which is effective for AC power may not be a good ground for higher radio frequencies. A ground wire could be long enough to act as a receiving antenna. Good RF grounding can generally be achieved by use of low inductance conductors (copper strap), bonding various equipments to each other and/or a good earth ground.

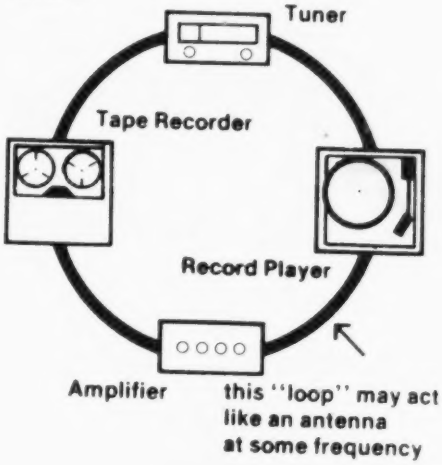
CAUTION: ***BEFORE GROUNDING, MAKE CERTAIN THAT THE EQUIPMENT DOES NOT HAVE ONE SIDE OF ITS POWER LINE CONNECTED TO ITS CHASSIS. IF IT DOES, GROUNDING THE CHASSIS WOULD BE HAZARDOUS AND COULD RESULT IN OVERLOADED ELECTRICAL CIRCUITS.***

e Some equipment may be fitted with a three conductor power cord. This type of equipment should have the grounding conductor of its power cord internally connected to its chassis and cabinet (if the cabinet is metal). This type of equipment may not need to be grounded separately. Attaching a separate ground to such equipment might result in the formation of a ground loop. A ground loop may aggravate any interference. Ground loops are circuits that have zero DC potential between points but may have enough AC or RF potential between points to allow AC or RF currents to flow. When devising grounding and bonding connection arrangements take care to avoid creating ground loops.

Figure 3 shows the proper and improper methods of grounding components.

Grounding Circuits

Wrong



Right

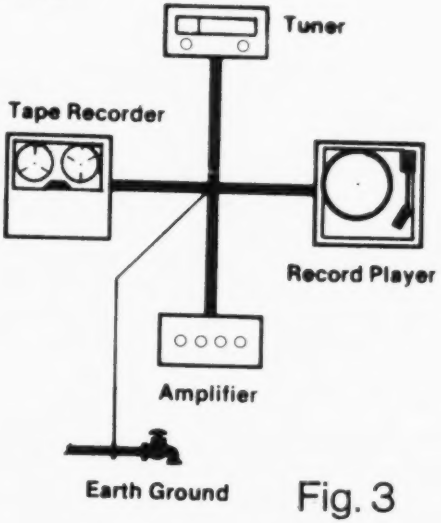


Fig. 3

f Before actually connecting a ground to any equipment, measure the voltage between the chassis and ground. Take measurements with the equipment on and off. If any appreciable voltage is found between the chassis to be grounded and the ground wire, determine the voltage source before making the connection.

CAUTION: ***SOME EQUIPMENT CHASSIS ARE AT LINE VOLTAGE POTENTIAL AND CANNOT BE CONNECTED DIRECTLY TO GROUND. IN THESE CIRCUMSTANCES, A CERAMIC CAPACITOR OF 0.001 MFD AT 1 KV SHOULD BE PLACED IN THE GROUND LEAD. THIS CAPACITOR ACTS AS A SHORT TO RF BUT AN OPEN CIRCUIT TO THE 60 HZ POWER LINE.***

g SHIELDING. All speaker leads connected to audio equipment should consist of two conductor wires with a separate shield. The shield should be grounded ONLY at the amplifier end, and should not be used as an audio conductor. The two internal wires should be connected to the speaker.

h POWER LINE FILTER. RF may enter the audio device through the AC power line. There are several commercially available brands of power line filters. A power line filter located at a wall outlet will not prevent RF pickup by the line cord between the filter and the amplifier. A power line filter such as the one shown in Figure 1 on page 43 may be constructed when necessary. Place the filter as close as possible to the point where the AC cord enters the amplifier.

i POOR ELECTRICAL CONNECTIONS. Poor solder connections or old electrolytic capacitors may cause an audio rectification problem. If all previous tests have failed, try resoldering all connections in the amplifier. Also replace electrolytic capacitors. Before actually replacing an electrolytic capacitor, try paralleling the original capacitor with a properly functioning capacitor of like value. This should reveal any bad capacitor.

TRANSISTOR EQUIPMENT

RF detection usually occurs in the input circuits of amplifiers. It can usually be eliminated by the use of a shunt capacitor, as shown in Figure 4. A resistor capacitor combination may also be used as shown in Figure 5. Make sure that the filter network you use does not effect the transistor biasing or the amplifier's frequency response.

Capacitor values are not critical. However, ceramic capacitors are best. Paper or plastic capacitors are not as effective for bypassing RF due to internal and lead inductance.

Shunt Capacitor Bypassing

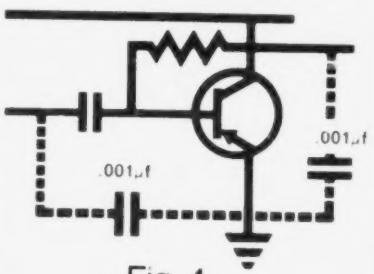


Fig. 4

Resistor Capacitor Bypassing

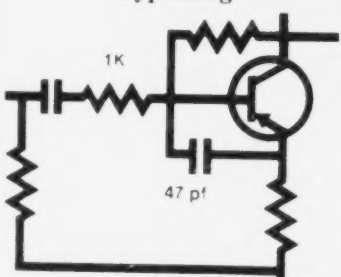


Fig. 5

Leads should be kept as short as possible especially with bypass capacitors. The lead length determines the resonant frequency, and therefore, the effectiveness of bypassing. Bypassing directly to the emitter is often more effective.

Connections to the chassis or other grounds may have more induced RF than the signal lead. If the interference increases, a ground loop has been created. When this happens, try the inductor method. See Figure 6.

Inductive Filtering

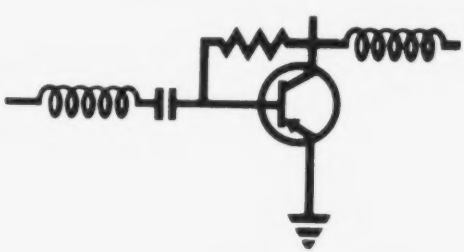


Fig. 6

1.5 mHy-up to 20 MHz
500 μHy-20 to 50 MHz
100 μHy-50 to 500 MHz

ELECTRONIC ORGANS

Organ circuits can be isolated by using the swell pedal, band box volume, or tabs (draw bars). By adjusting each of these controls individually, you can observe their respective effect on interference. If the volume of the interference changes when a control is adjusted, the RF is being detected by the amplifier somewhere before that control. If the volume of the interference does not change, the interference is being detected after that control.

Use this method to determine where the RF is entering the organ. Then insert the proper filter into the appropriate circuit.

TELEPHONES

Telephone interference caused by nearby transmitters can usually be eliminated with proper filtering in the proper places. The interference in older rotary dial telephones (without special features) can usually be suppressed by bypassing the carbon microphone. To suppress such rectification install a 0.001 mfd disc ceramic capacitor in the back of the mouthpiece in the handset. When possible, solder the capacitor directly to the microphone contact fingers with the shortest possible leads.

There are commercially available RF filters. They plug into modular jacks and block RF on the incoming line. However, they will not prevent RF pickup by the cord between the telephone and modular plug, or the cord between the handset and telephone body. Try installing RF filters before attempting other remedies.

RF energy must not reach internal telephone components such as varistors, diodes and the carbon microphone. Sophisticated telephones with features such as memories, automatic redial, speakers, push button dialing, and sound amplification contain complex circuits. These circuits are susceptible to RF energy. Shielding and bypassing are necessary to isolate the affected circuits from the high RF levels.

The cost of materials and labor necessary for adequate shielding and filtering may far exceed the cost of some instruments being serviced. If so, it may be more practical to replace the instrument with a make and model that is less sensitive to RF pickup.

Telephone equipment leased from the telephone company should only be modified by telephone company personnel. Consult the dealer or manufacturer of consumer owned equipment for guidance in modifications.

Only registered telephone refurbishers are allowed to make major modifications that may affect the telephone's operating characteristics or requirements for FCC registration.

ADDITIONAL INFORMATION for service technicians about resolving interference is available from local libraries and technical bookstores. Handbooks are also available from:

Electronic Industries Association (EIA)
2001 Eye Street, NW
Washington, D.C. 20006

American Radio Relay League (ARRL)
225 Main Street
Newington, Connecticut 06111

CHAPTER 10

FCC COMPLAINT PROCEDURES AND INTERFERENCE COMPLAINT FORM

FCC COMPLAINT PROCEDURES

If the suggestions provided in this handbook do not resolve your particular interference problem complete the questionnaire on page 59 and mail it to the nearest FCC office. It is important that you accurately respond to as many of the questions as possible.

Once we receive your questionnaire, we will take the following steps:

1 Write the owner or operator of the suspected equipment and send you a copy of our letter.

2 Instruct that the equipment owner take certain actions and conduct prescribed tests. Mutual cooperation is crucial to properly perform these tests.

3 Request that the equipment owner send the FCC a written report within 15 days of receiving our instructions. You will be asked to verify this report.

4 Further evaluate your complaint if the interference persists.

NOTE ON CONFIDENTIALITY

If you request confidentiality, we will make every effort to honor your request. However, we will not be able to use certain interference resolution methods without releasing your name. This is because certain tests must be coordinated with the operator. We will still use every resolution method that doesn't require that your name be released. In the unlikely event that this matter ends in a court or Commssion hearing, a presiding official could order us to release your name. We would then no longer be able to withhold your identity.

INTERFERENCE COMPLAINT QUESTIONNAIRE

While we may not be able to visit you, we can evaluate the information you provide and offer some suggestions to help resolve your interference problem(s). The assistance we provide will be based upon your responses to the following questions:

Date _____

1. Name _____
   Address _____
   City _____ County _____ State _____ Zip Code _____

2. Work telephone number ( ) _____
   Home telephone number ( ) _____

3. Indicate whether you prefer being contacted at
   ____ Home ____ Work
   Most convenient time for us to call _____

4. Type of dwelling (check one)
   ____ Single Dwelling ____ Apartment ____ Mobile Home
   ____ Other (describe) _____

5. Are your neighbors affected by the same interference problem?
   ____ Yes ____ No ____ Unknown

6. Equipment receiving interference (check one or more)
   ____ TV VHF channels (list channel numbers _____)
   ____ TV UHF channels (list channel numbers _____)
   ____ AM radio ____ FM radio ____ Stereo ____ VCR
   ____ Video game attachment
   ____ Telephone (owned) ____ Telephone (leased)
   ____ Cordless telephone
   ____ Other (describe) _____

Equipment
Make _____
Model _____
Model number _____
Year purchased _____

7. Check the source of interference below. If the source is unknown, proceed to question 12.

___ Amateur transmitter
___ CB transmitter
___ FM transmitter (station call letters _____)
___ Unknown
___ Other (describe) _____
Electrical (type of device) _____

8. If the source is electrical, provide the following information (check one or more). If the source is not electrical, proceed to question 9.

___ Test outlined on page 11 of this handbook was conducted
___ Device not found within home
___ Neighbors affected
___ Local power company contacted

If local power company was contacted, provide:

Company _____
Address _____
_____
Person contacted _____
Title _____
Telephone number _____
Results of contact _____
_____
_____

9. If the interference is caused by CB or Amateur radio transmissions which you can understand, briefly describe them on a separate sheet.

10. Transmitter operator:

Name _____
"Handle" _____ Call Sign _____
Address _____
Telephone number _____
Vehicle license plate number _____

11. Have you contacted the radio operator? ____ Yes ____ No
If yes, results of contact
_____
_____
_____

12. Check appropriate boxes to describe which actions you have taken to resolve the interference
____ Shielded and/or grounded affected device
____ Replaced or repaired broken or disconnected TV antenna wires
____ Replaced indoor TV antenna with outdoor antenna
____ Installed filter
____ Contacted service technician or manufacturer
If service technician or manufacturer was contacted, provide:

Technician name and service company _____
Address _____
Telephone number _____
Results of contact _____
_____

Manufacturer _____
Address _____
Person contacted _____
Telephone number _____

Provide any additional manufacturer information on a separate sheet.

If audio devices are receiving interference refer to page 20 of this handbook, then proceed to question 14 below.

13. Circle the patterns that best describe your TV interference.

Horizontal

Vertical

Diagonal

Also describe the interference sound. _____
_____

14. Is the interference constant? ____ Yes ____ No
If not, how long does each period of interference last?
____ seconds ____ minutes ____ hours

15. Time(s) of day interference occurs:
____ a.m. ____ p.m.

16. Day(s) of week interference occurs:
____ Sun ____ Mon ____ Tues ____ Wed ____ Thurs
____ Fri ____ Sat ____ Everyday

17. Date interference last occurred _____

If only audio devices are receiving interference proceed to question 28.
If your telephones are receiving interference proceed to question 24.

18. Check the items that best describe your television antenna system.
If you are a cable subscriber proceed to question 21.

____ Indoor antenna (Rabbit ears or antenna built into set)
____ Outdoor antenna
____ Combined VHF/UHF ____ VHF ____ UHF
____ Outdoor rotatable antenna
____ Attic antenna
____ Master antenna (serving more than one TV set)

19. Does your TV antenna system include a booster amplifier?
____ Yes ____ No (Refer to page 16 of this handbook for information about booster amplifiers.)

20. Type of antenna lead-in wire used:
____ Coaxial (shielded) ____ Twin-lead (ribbon)

21. Is cable available in your community? ____ Yes ____ No
If yes, do you subscribe to it? ____ Yes ____ No

22. Do you use a:
____ Video game attachment
____ VCR

23. Have you contacted the cable company? ____ Yes ____ No
If yes, complete the following:

Cable company name _____
Address _____
_____
Person contacted _____
Title _____
Telephone number _____
Results of contact _____
_____
_____

24. If you are receiving telephone interference, answer the following questions:

Do you have more than one telephone? ____ Yes ____ No
If yes, are all of your telephones affected? ____ Yes ____ No
Are your phones ____ Leased ____ Owned ____ Both
Which telephone is receiving interference?
____ Leased ____ Owned ____ Both

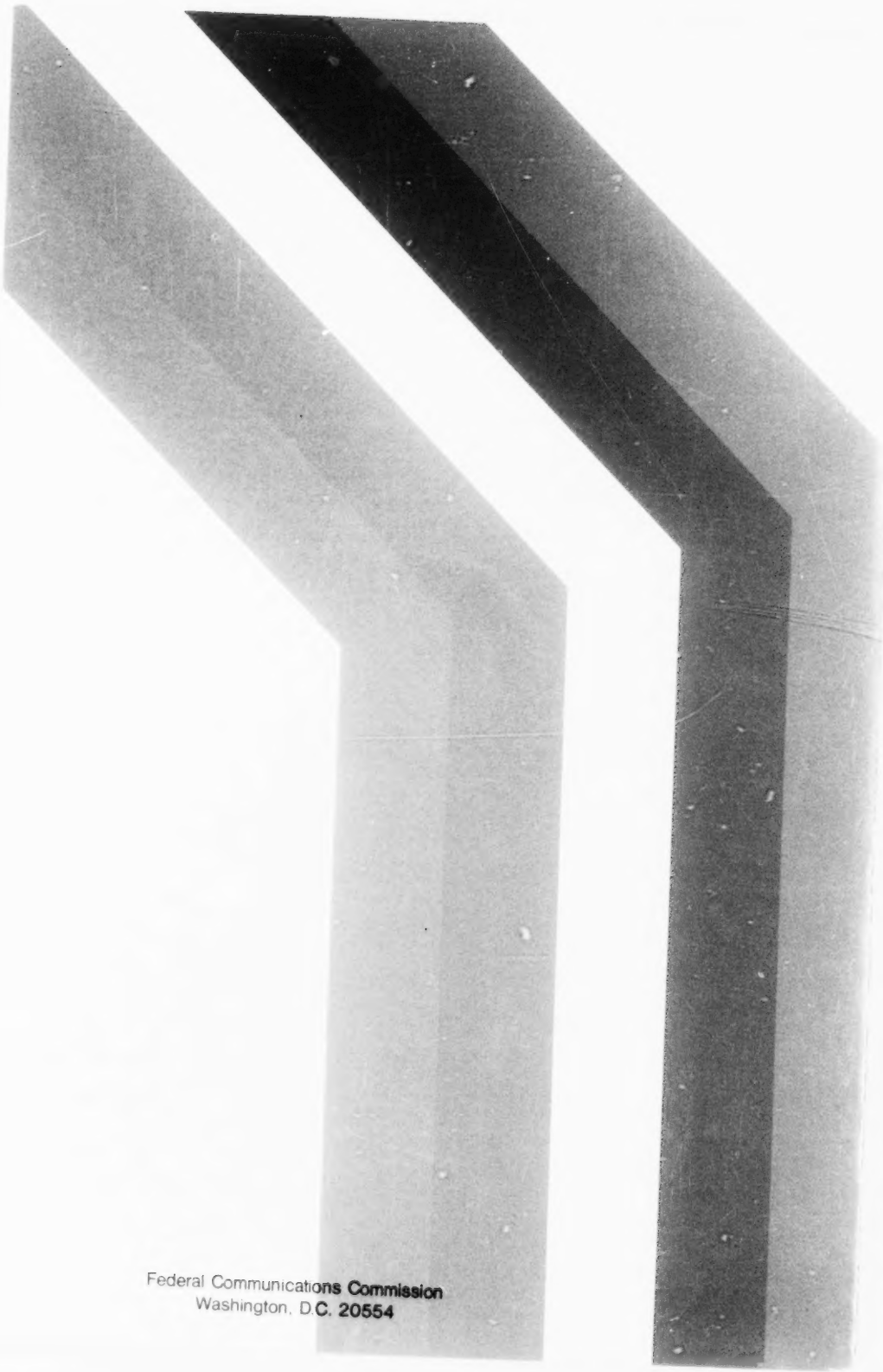
25. Have you contacted the telephone manufacturer or your telephone company? ____ Yes ____ No
If yes, complete the following:

Company _____
Address _____
_____
Person contacted _____
Title _____
Telephone number _____
Results of contact _____
_____
_____

26. Were telephone filters installed? ____ Yes ____ No
If yes, where were the filters installed in the telephone system?
____ At the drop wires leading to the home
____ Inside the telephone handset
____ All of the above

27. Do you use a:
____ Satellite Dish
____ Home Computer

28. Provide any other information that you think will help us assist you.



Federal Communications Commission
Washington, D.C. 20554